INCREMENT "F" AND
ENERGY SAVINGS OPPORTUNITY SURVEY (ESOS)
OF THE ENERGY ENGINEERING ANALYSIS PROGRAM

FORT HOOD, TEXAS

FINAL REPORT
EXECUTIVE SUMMARY

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ENERGY SAVINGS OPPORTUNITY SURVEY (ESOS)
FORT HOOD, TEXAS

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FORT HOOD, TEXAS

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1.0 INTRODUCTION

This document is the Executive Summary of the Final Report of the Increment "F" and the Energy Savings Opportunity Survey (ESOS) for Fort Hood, Texas prepared under Contract No. DACA63-84-C-0135 between the U.S. Army Engineer District, Fort Worth, Corps of Engineers, and Chilton Engineering, Chartered. This project has been executed as a part of the Department of the Army's Energy Engineering Analysis Program (EEAP). The overall objective of this project is to reevaluate selected projects from previous studies, to evaluate specific new projects, and to develop No Cost/Low Cost maintenance and repair type projects that will reduce energy consumption in compliance with the Army Facilities Energy Plan (AFEP).

The "Energy Conservation Investment Program (ECIP) Guidance", described in the letter from DAEN-ZCF-U, 4 March 1985 [2] established criteria for ECIP projects and is utilized for performing the economic analyses of all Energy Conservation Opportunities (ECO's) and projects. Construction cost escalation to Program Year FY 1988 for DD Form 1391 submission is calculated using the guidelines contained in AR 415-17 and the latest applicable edition of the Engineer Improvement Recommendation System (EIRS) bulletin, which updates the Tri-Service MCP Index [3]. The "General Scope of Work (GSOW) for an Energy Savings Opportunity Survey (ESOS)", HNDED-PM/ME, dated 12 March 1984, revised 10 July 1984 [1], is used extensively in performing this study and is presented in Appendix C. This appendix also contains the "Detailed Scope of Work (DSOW)" [1] and the "Prenegotiation Conference Minutes" which define the specific projects and buildings addressed in this study, as well as presenting the overall study methodology.

The study methodology for the ESOS at Fort Hood, Texas is segmented into two phases of work. Phase I involves data gathering, field surveys, identification of Energy Conservation Opportunities (ECO's), and preliminary ECO analyses. Phase II includes all final energy and economic analyses, categorization of projects for funding considerations, preparation of programming documents, and preparation of the Final Report. The Final Report presents all methods, results, and recommendations of this study. This Executive Summary specifically addresses the study results pertaining to the completion of all phases of the study. The Final Report volume titles are delineated below for which this Executive Summary applies:

Volume I :	Executive Summary, Main Report, Appendices A through F
Volume II :	Appendices G and H
Volume III:	Programming Documents

The General Scope of Work located in Appendix C of the Main Report identifies the general guidelines for completing the study. The contents of the GSOW are not reiterated here and the reader is referred to this document for descriptions of the general requirements of the study. The Detailed Scope of Work (also Appendix C), identifies the specifics of the analyses to be performed. Due to its importance, the DSOW is summarized below.

The projects considered are organized into three categories:

- Specific projects for specific buildings.

- Full audit buildings in which all applicable ECO's listed in Annex "A" of the GSOW are evaluated.
- No Cost/Low Cost maintenance and repair type projects which can be implemented by the Director of Engineering and Housing personnel (or Director of Facilities Engineering (DFE)).

In several cases a building is defined as a "typical building" and is chosen to represent other similar buildings. It is, therefore, important to become familiar with the full scope of this study.

Table 1.0.1 identifies the specific projects and the number of buildings to be analyzed for each project. These projects represent specific areas which the Fort Hood DFE deems as practical areas for energy conservation and as having a high potential for economic feasibility. Many of the buildings analyzed are considered "typical" buildings in which the project results can be applied to other similar buildings. Annex "B" of the GSOW, Paragraph 5 (Appendix C), identifies the buildings represented by each typical building. The DFE identified which represented buildings were to be incorporated into a potential ECIP project created by a feasible analysis of the typical building.

The three full audit buildings are Administration Building No. 28000 and Flight Trainers and Simulators Nos. 7019 and 7050. These buildings are selected by the DFE because they were not addressed in the previous EEAP study and have a relatively high energy consumption. All applicable ECO's listed in Annex "A" of the GSOW are considered for these buildings.

No Cost/Low Cost projects, which can be implemented by DFE personnel, are analyzed for a large variety of buildings, the types and numbers of which are listed in Table 1.0.2. These projects are maintenance and repair type projects which can be implemented by the Director of Engineering and Housing Personnel. No Cost/Low Cost projects are analyzed for "typical" buildings and the results are extrapolated where applicable. In order to allow analysis of the many other buildings at Fort Hood where an ECO may apply, "workbooks" are developed for a number of the feasible No Cost/Low Cost projects.

Throughout implemention of this study, building repetition and similarities are used whenever possible to reduce the volume of analyses performed. These similarities are utilized only when they do not jeopardize the accuracy of the analysis results.

To summarize, the overall objective of this study is to reevaluate selected projects from previous studies, to evaluate specific new projects, and to develop No Cost/Low Cost maintenance and repair type projects. These projects are evaluated for specific buildings at Fort Hood as defined in the Detailed Scope of Work (Appendix C). The primary intent of this approach is to effect the largest possible energy usage reduction by concentrating study efforts in areas deemed to have the most impact, and in areas which are the most practical and useful to Fort Hood.

Section 2.0 of this Executive Summary discusses the ECO's analyzed, the results of the analyses, and funding categorization for the feasible projects. Section 3.0 summarizes the results of this ESOS, including conclusions and recommendations.

TABLE 1.0.1

SPECIFIC PROJECTS

Administrative Facilities (3 Buildings): Evaluate the use of "Pulse Type" (high efficiency) furnaces.

Administrative Buildings 1st CAV HQ (1 Building): Evaluate the use of storage tanks vs. point water heaters for small areas.

Barracks (1 Building): Evaluate the use of urethane type material on exterior surfaces of concrete block constructed buildings.

Barracks (1 Building): Evaluate the use of a reflective coating for built-up roofing at the time of repair. Evaluate increasing the urethane base in roofs at the time of repair.

Barrack (2 Buildings): Evaluate increasing the use of the FM controls for setting back large chillers by reset controls in mechanical room(s).

Chapels (1 Building): Evaluate rezoning of the HVAC system to separate the chapel area from work areas.

Dental Clinics (1 Building): Evaluate the retrofit of the HVAC system to a Variable Air Volume System.

Motor Pools (2 Buildings): Evaluate controlling exterior lighting in thirty-one (31) motor pools.

Evaluate gas radiant heaters.

Swimming Pool (1 Building): Re-evaluate solar heating of indoor pool, utilizing applicable criteria contained in the General Scope of Work. Previous Project T-889.

Family Housing (80 Units): Evaluate the use of waste heat from condensing units to preheat domestic hot water.

Chaffee Village (8 Units)
Comanche I (3 Units)
Comanche II (8 Units)
Comanche III (9 Units)
McNair Village (2 Units)
Montague Village (16 Units)
Patton Park (3 Units)
Pershing Park (8 Units)
Venable Village (6 Units)
Wainwright Village (11 Units)
Walker Village (6 Units)

TABLE 1.0.2

NO COST/LOW COST BUILDING LIST

BUILDING TYPE	NUMBER OF BUILDINGS
NON-RESIDENTIAL	
Administrative	26
Barracks	9
Chapels	12
Dental Clinics	5
Flight Trainers and Simulators	2
Motor Pools	8
Swimming Pools	2
RESIDENTIAL	
Chaffee Village	8
Comanche I	3
Comanche II	8
Comanche III	9
McNair Village	2
Montague Village	16
Patton Park	3
Pershing Park	8
Venable Village	6
Wainwright Village	11
Walker Village	6

2.0 ENERGY CONSERVATION ANALYSES

Section 2.0 of this Executive Summary discusses the energy conservation analysis procedure and results from this ESOS. Energy Conservation Opportunities (ECO's) are identified from two sources, the Scope of Work, and directly in the field. Projects originating from the Scope of Work include:

- Specific projects for typical buildings both of which are identified in the DSOW.

- Full audit building projects where the buildings to be considered are identified in the DSOW.

- No Cost/Low Cost projects where the buildings to be considered are identified in the DSOW.

After identification of all ECO's, a technical evaluation is prepared. Upon assurance of technical feasibility, a thorough economic analysis is performed in accordance with ECIP guidelines. The analysis determines economic feasibility which is determined by demonstrating a discounted Savings to Investment Ratio (SIR) greater than one (1.0).

Each ECO is categorized into one of nine project types for funding considerations, based on implementation cost, potential energy savings and coordination with Fort Hood personnel.

Section 2.1 describes the project categories, while Sections 2.2 through 2.6 discuss each ECO, after it has been categorized into a project category.

2.1 Project Categorization

The ECO's developed within this ESOS study are categorized and described. Utilizing the implementation cost and economic feasibility results, ECO's or combinations of ECO's are categorized for funding considerations. The categorization of projects was accomplished by consulting with the Fort Hood engineering personnel.

ECO's are categorized into nine (9) project types. The classification of ECO's enables identification of which projects should be implemented through facility funds, through the Energy Conservation Investment Program (ECIP), through other funding programs (QRIP, OSD PIF, PECIP), or do not fall into any funding categories. These categories are defined below.

- General Recommendations. General recommendations apply to the entire facility representing projects essential to a continuing maintenance program for attaining and maintaining efficient energy use. These measures involve operation and maintenance procedures in which the quantification of energy savings is impossible to define. These recommendations are to be implemented by facility personnel on a continuing basis.

- Non-ECIP Projects. These projects are economically feasible (SIR greater than one) which are not appropriate for the ECIP funding programs and are not placed into the general recommendations category.

  - No Cost/Low Cost Projects. These projects are characterized by requiring minimal or no capital investment, a quick return on any investment required, and immediate implementation by the Director of Engineering and Housing personnel. No Cost/Low Cost projects are synonymous with operation, maintenance, and repair type projects.

  - Quick Return on Investment Program (QRIP). This program is for projects which have a total cost not over $100,000 and will amortize in two (2) years or less.

  - OSD Productivity Investment Funding (OSD PIF). This program is for projects having a total cost greater than $100,000 and an amortization period of four (4) years or less.

  - Productivity Enhancing Capital Investment Program (PECIP). This program is for projects having a total cost of more than $3,000 and an amortization period of four (4) years or less.

  - Other Projects. ECO's recommended for implementation that do not qualify for any specific funding program and do not appropriately fit into any other category.

- ECIP Projects. ECO's or combinations of ECO's which qualify for ECIP funding must comply with the investment, energy savings, and economic feasibility criteria outlined in the Energy Conservation Investment Program, governed by the ECIP Guidance, dated 4 March 1985. ECIP projects require a capital investment of greater than $200,000 and must exhibit a SIR greater than one.

- ECO's Requiring Further Investigation. These projects are potentially viable energy conservation projects which cannot be satisfactorily treated within the scope of this contract. They require further study and analysis in order to be classified into one of the other categories outlined herein.

- Non-Feasible ECO's. All ECO's which are considered but are not feasible. Feasibility may be determined based on practical reasons, economics (SIR less than one), or applicability.

2.2 General Recommendations

General recommendations are operation and maintenance procedures that apply to the entire facility. Although energy savings are impossible to define, the implementation of these projects is crucial to attaining identified energy savings and maintaining efficient energy use. These recommendations are to be implemented by facility personnel on a continuing basis.

2.2.1 Facility Maintenance

The major cause of energy waste at Fort Hood is the poor condition of building control systems and equipment. In virtually all non-residential buildings surveyed, the primary energy deficiency can be remedied by the repair, calibration, and proper adjustment of HVAC control systems. In addition, most HVAC equipment surveyed requires general cleaning and maintenance. The cause of these extremely poor HVAC operating conditions can only be attributed to the poor historical maintenance of these systems.

The magnitude of this problem with respect to energy efficiency and building comfort cannot be overstated. The following types of problems were apparent in all buildings surveyed:

- Time clocks were either disconnected, made nonfunctional by removal of the clock time set switches, or the control system was put into "manual" mode instead of "automatic".

- Outside air temperature controllers for boiler lockout control were defeated by adjustment of the temperature out of the proper range (i.e., set very high).

- Building and DHW temperature controllers for pump lockout were set out of range.

- Fan and pump motor controllers were set in the "manual" mode instead of in the "automatic" position.

- Thermostats were out of calibration and set at various temperatures within a single building.

- Damper motor actuator arms were disconnected.

- Economizer limit temperature controllers were set out of the proper range.

- Static pressure manometers used to identify dirty filters were not maintained (no fluid).

- Air filters were generally dirty. In many instances the automatic continuous type filters were either broken or just had not been adjusted to clean positions.

- Disposition Form, dated 21 August 1984, from AFZF-DE-EPO, "Effectiveness of the F.M. Radio Control System for Control of Fort Hood's Air Conditioning", states that thirty-nine percent (39%) of the F.M. controllers were inoperative.

The above deficiencies contribute to the lack of operational and temperature control of the building HVAC systems. These systems are operating twenty-four (24) hours per day every day of the year, when occupancy only occurs eight (8) to ten (10) hours per day on weekdays. Similarly, the temperature control systems are providing only limited control, if any.

From discussions with various personnel at the facility, it was determined that the maintenance program is lacking as evidenced by the condition of the

equipment surveyed. First, control problems are solved by the process of eliminating possible causes (such as disconnecting the ambient air temperature lockout control) until the problem is solved, instead of determing the actual cause of the problem. Secondly, the maintenance interval period is too long. In many cases, a building will be visited only once or twice a year and the investigation is not comprehensive.

It should be noted that the Family Housing buildings are maintained by a private contractor (as of July 1985) and were in excellent condition. It is understood that this is the second contractor hired in that the first did not provide the quality of service that the current contractor does. It may be wise to investigate obtaining a highly qualified and reputable outside contract for maintaining non-residential buildings.

Many of the above HVAC system deficiencies are addressed within projects analyzed within this study. There are some in which energy savings are impossible to define. Specific maintenance and cleaning items that need attention for each building are delineated in Section 4.2.2 of the Main Report. They are not reiterated here.

2.3 Non-ECIP Projects

Non-ECIP projects are economically feasible projects which are not appropriate for ECIP funding, and are not considered as general recommendations. Five divisions are delineated here: No Cost/Low Cost projects, QRIP projects, OSD PIF projects, PECIP projects and "Other" projects. ECO's which are placed into these categories are described here.

2.3.1 No Cost/Low Cost Projects

No Cost/Low Cost projects are measures characterized by requiring minimal or no capital investment, a quick payback, and immediate implementation by Fort Hood personnel. Of all projects classified in the Scope of Work as No Cost/Low Cost, fourteen (14) have proven feasible, and are discussed here. Section 3.2.3 of the Main Report addresses all projects classified as No Cost/Low Cost ECO's.

2.3.1.1 Non-Residential Buildings

- Lower Domestic Hot Water (DHW) Temperature. Standby heat loss from DHW tanks and pipes are proportional to the setpoint temperature. By lowering the setpoint, losses are reduced, and energy is saved. This project is feasible for nineteen (19) buildings, with SIR's ranging from 4.77 to 232.73. The total project SIR is 75.39. Analysis details are located in Appendix G1.1, in Volume II of this report.

- Install flow Restrictors. DHW consumption can be reduced by installing low flow shower heads in the showers. This action of restricting hot water flow saves energy without reducing comfort. This project is feasible for two (2) pool buildings, with SIR's ranging from 43.34 to 92.25. The total project SIR is 73.21. Analysis details are located in Appendix G1.2, in Volume II of this report.

- Insulate DHW Tanks. The rate of heat loss from DHW tanks can be reduced significantly by adding insulation. By reducing the heat loss, less energy is required to maintain the DHW at the setpoint temperature. This project is feasible for one (1) administration building, with an SIR of 1.07. Analysis details are located in Appendix G1.3, in Volume II of this report.

- Insulate Pipes. This project recommends the insulation of bare piping for HVAC steam supply or hot water supply/return piping. Convective heat losses will be reduced. This project is feasible for thirteen (13) buildings, with SIR's ranging from 1.06 to 7.75. The total project SIR is 5.14. Analysis details are located in Appendix G1.4, in Volume II of this report.

- Install Electronic Ignition. Electronic ignition eliminates the pilot light and continuous gas use inherent in continuous burning pilot lights. The project recommends the replacement of these pilot lights with intermittent electronic spark ignition devices. This project is feasible for two (2) barracks, both having an SIR of 1.62. Analysis details are located in Appendix G1.6, in Volume II of this report.

- Install Economizer Controls. An economizer reduces the amount of cooling required when the heat content of the outside air is less than that of recirculated air. Cooling can be achieved with outside air rather than with mechanical cooling. This project proposes repairing the economizer control on the cooling systems in three (3) buildings. The SIR's range from 3.00 to 39.25. The total project SIR is 24.06. Analysis details are located in Appendix G1.7, in Volume II of this report.

- Auxiliary Equipment Operation Control. This project addresses the savings that can be realized by installing time clocks on constant circulating DHW systems, vacuum pumps and air compressors, and by installing timers on selected exhaust fans. Savings are achieved by reducing operational hours. Seven (7) buildings are feasible for this project, with SIR's ranging from 2.34 to 37.07. The total project SIR is 21.55. Analysis details are located in Appendix G1.8, in Volume II of this report.

- Ambient Air Boiler Lockout Control. Savings realized by repairing boiler lockout controls are attributed to eliminating boiler skin losses and water circulatory power demand. Controls in this project are set to lockout the boiler and hot water circulation pump for ambient temperatures in excess of 65°F. This project is feasible for thirteen (13) buildings, with SIR's ranging from 1.14 to 45.21, with a total project SIR of 4.58. Analysis details are located in Appendix G1.9, in Volume II of this report.

- Hot Water Reset Controls. This project calls for the repair of existing controls to provide hot water reset temperature control. The hot water temperature will be automatically controlled in relation to ambient air temperature to better match heating needs. This project is feasible for one (1) barracks, and has an SIR of 85.48. Analysis details are located in Appendix G1.10, in Volume II of this report.

- Reduce Lighting Levels. This project recommends that overlit areas (identified by foot candle measurement) should have a sufficient quantity of lamps removed to reduce average lighting levels to prescribed values set forth in DOD documentation. This project is feasible for thirteen (13) buildings. The SIR's range from 1.84 to 107.69, the total project SIR being 9.48. Analysis details are located in Appendix G1.13, in Volume II of this report.

- Reduce Infiltration. Energy is used to condition outside air which leaks in through openings in a building envelope. Sealing these spaces (e.g., repairing windows, weatherstripping, caulking doors and windows) will reduce the infiltration of outside air, reducing conditioning loads and associated energy consumption. This project is feasible for eight (8) motor pools, with SIR's ranging from 2.05 to 2.85. The total project SIR is 2.46. Analysis details are located in Appendix G1.18, in Volume II of this report.

- Install Storm Windows. This project recommends installing storm windows to add a dead air layer between the glazed window surfaces to increase the resistance to heat transfer. This lowers the energy requirements for maintaining the interior at comfort levels. This project applies to one (1) flight simulator. The SIR is 1.01. Analysis details are located in Appendix G1.19, in Volume II of this report.

2.3.1.2 Residential Buildings (Family Housing)

- Lower DHW Temperature. As with the non-residential buildings, lowering the DHW temperature setpoint will reduce heat loss and, thereby, save energy. This project is feasible for twenty-six (26) family housing buildings. The SIR's range from 1.36 to 14.36, with a project SIR of 8.26. Analysis details are located in Appendix G1.14, in Volume II of this report.

- Insulate DHW Tanks. As with the non-residential buildings, insulating the DHW tanks will reduce heat loss and, thereby, lower energy consumption. This project is feasible for twenty-six (26) family housing buildings. The SIR's range from 1.16 to 1.89, totalling 1.51. Analysis details are located in Appendix G1.17, in Volume II of this report.

The analysis results on a per building basis are delineated in Table 2.3.1. The potential energy savings from implementation of all the No Cost/Low Cost projects are 12,242.2 MBtu/Yr of energy (natural gas and electricity). The total cost is $48,084 for implementation, which will save $40,055. The SIR is 10.20 and the simple payback is 1.20 years. Each No Cost/Low Cost project is further described in Section 3.2.3 of the Main Report, Volume I.

TABLE 2.3.1
NO COST/LOW COST PROJECT SUMMARY
FT HOOD, TX
FEASIBLE PROJECTS ONLY

PROJECT	BUILDING NUMBER	SOURCE ENERGY SAVINGS (MBTU/YR)	TYPE (e)	FIRST YEAR DOLLAR SAVINGS ($/YR)	COST TO IMPLEMENT: MATERIAL COST ($)	COST TO IMPLEMENT: JOBHOURS TRADE	COST TO IMPLEMENT: JOBHOURS HOURS	COST TO IMPLEMENT: TOTAL COST ($)	SAVINGS TO INVESTMENT RATIO (SIR)
LOWER DOMESTIC HOT WATER TEMPERATURE	B14020	45.1	G	170	0	Bldg Laborer	0.5	12	232.73
LOWER DOMESTIC HOT WATER TEMPERATURE	DC330	36.6	G	137	0	Bldg Laborer	0.5	12	187.55
LOWER DOMESTIC HOT WATER TEMPERATURE	B9418	34.7	G	130	0	Bldg Laborer	0.5	12	177.91
REDUCE LIGHTING LEVELS	A9216	117.2	C	346	0	Electrician	1.0	35	107.69
LOWER DOMESTIC HOT WATER TEMPERATURE	C2224	37.4	E	109	0	Bldg Laborer	0.5	12	101.64
LOWER DOMESTIC HOT WATER TEMPERATURE	B29009	18.6	G	70	0	Bldg Laborer	0.5	12	95.82
LOWER DOMESTIC HOT WATER TEMPERATURE	B29008	18.8	G	70	0	Bldg Laborer	0.5	12	95.82
INSTALL FLOW RESTRICTORS	P23001	687.5	G	2,591	225	Plumber	6.3	469	92.25
HOT WATER RESET CONTROLS	B12003	46.8	G	176	0	Plumber	1.0	34	85.48
LOWER DOMESTIC HOT WATER TEMPERATURE	P23001	16.2	G	61	0	Bldg Laborer	0.5	12	83.45
LOWER DOMESTIC HOT WATER TEMPERATURE	B21008	63.6	G	239	0	Bldg Laborer	2.0	48	81.30
LOWER DOMESTIC HOT WATER TEMPERATURE	B12003	61.8	G	232	0	Bldg Laborer	2.0	49	79.39
LOWER DOMESTIC HOT WATER TEMPERATURE	B37008	58.8	G	221	0	Bldg Laborer	2.0	48	75.64
LOWER DOMESTIC HOT WATER TEMPERATURE	DC9440	14.1	G	53	0	Bldg Laborer	0.5	12	72.55
LOWER DOMESTIC HOT WATER TEMPERATURE	B10001	21.6	G	81	0	Bldg Laborer	1.0	24	55.41
LOWER DOMESTIC HOT WATER TEMPERATURE	B16003	35.9	G	135	0	Bldg Laborer	2.0	48	46.20
AMBIENT AIR BOILER LOCKOUT CONTROL	B12003	62.3	C	217	0	Electrician	2.0	73	45.21
AMBIENT AIR BOILER LOCKOUT CONTROL	B37008	62.3	C	217	0	Electrician	2.0	73	45.21
INSTALL FLOW RESTRICTORS	P112	206.2	G	777	144	Plumber	4.0	300	43.34
LOWER DOMESTIC HOT WATER TEMPERATURE	MP9553	8.2	G	30	0	Bldg Laborer	0.5	12	41.00
LOWER DOMESTIC HOT WATER TEMPERATURE	MP38014	7.7	G	29	0	Bldg Laborer	0.5	12	39.64
INSTALL ECONOMIZER CONTROLS	A28000	341.5	E	972	0	HVAC Tech	8.0	283	39.25
AUXILIARY EQUIPMENT OPERATION CONTROL(a)	DC36014	936.6	E	2,753	421	Electrician	10.5	846	37.07
INSTALL ECONOMIZER CONTROLS	B14019	262.4	E	739	0	HVAC Tech	8.0	283	29.87
AUXILIARY EQUIPMENT OPERATION CONTROL(b)	DC36014	936.6	E	2,753	615	Electrician	12.2	1,132	27.72
AUXILIARY EQUIPMENT OPERATION CONTROL(a)	DC33001	468.3	E	1,376	257	Electrician	8.3	581	26.99
AUXILIARY EQUIPMENT OPERATION CONTROL(a)	DC39033	468.3	E	1,376	257	Electrician	8.3	581	26.99
AUXILIARY EQUIPMENT OPERATION CONTROL(a)	DC9440	468.3	E	1,376	257	Electrician	8.3	581	26.99
AUXILIARY EQUIPMENT OPERATION CONTROL(b)	DC330	408.9	E	1,202	240	Electrician	6.7	508	26.93
LOWER DOMESTIC HOT WATER TEMPERATURE	C12012	4.9	G	18	0	Bldg Laborer	0.5	12	24.64
REDUCE LIGHTING LEVELS	MP35023	238.0	C	779	0	Electrician	10.9	363	24.02
LOWER DOMESTIC HOT WATER TEMPERATURE	A34011	3.2	G	12	0	Bldg Laborer	0.5	12	16.36
AUXILIARY EQUIPMENT OPERATION CONTROL(b)	DC39033	281.0	E	826	257	Electrician	8.3	581	16.20
AUXILIARY EQUIPMENT OPERATION CONTROL(b)	DC33001	281.0	E	826	257	Electrician	8.3	581	16.20
AUXILIARY EQUIPMENT OPERATION CONTROL(b)	DC9440	281.0	E	826	257	Electrician	8.3	581	16.20
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH60104	5.8	G	21	0	Bldg Laborer	1.0	24	14.36
LOWER DOMESTIC HOT WATER TEMPERATURE	A9426	2.9	G	10	0	Bldg Laborer	0.5	12	13.64
AUXILIARY EQUIPMENT OPERATION CONTROL(c)	A28000	35.1	C	123	19	Electrician	3.6	145	13.03
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH60009	4.8	G	18	0	Bldg Laborer	1.0	24	12.32
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH51413	13.8	G	52	0	Bldg Laborer	3.0	72	12.05
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH60004	4.4	G	16	0	Bldg Laborer	1.0	24	10.91
REDUCE LIGHTING LEVELS	DC36014	1,135.8	C	3,908	0	Electrician	123.1	4,075	10.37
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH51433	4.2	G	15	0	Bldg Laborer	1.0	24	10.23
REDUCE LIGHTING LEVELS	A28000	1,304.3	C	4,585	0	Electrician	164.0	5,427	9.33
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH51426	7.2	G	27	0	Bldg Laborer	2.0	48	9.23

TABLE 2.3.1 (Continued)
NO COST/LOW COST PROJECT SUMMARY
FT HOOD, TX
FEASIBLE PROJECTS ONLY

PROJECT	BUILDING NUMBER	SOURCE ENERGY SAVINGS (MBTU/YR)	TYPE (e)	FIRST YEAR DOLLAR SAVINGS ($/YR)	COST TO IMPLEMENT: MATERIAL COST ($)	JOBHOURS: TRADE	JOBHOURS: HOURS	TOTAL COST ($)	SAVINGS TO INVESTMENT RATIO (SIR)
AUXILIARY EQUIPMENT OPERATION CONTROL(c)	DC39033	28.5	C	93	19	Electrician	3.6	145	9.03
AUXILIARY EQUIPMENT OPERATION CONTROL(c)	DC9440	28.5	C	93	19	Electrician	3.6	145	9.03
REDUCE LIGHTING LEVELS	DC9440	268.5	C	933	0	Electrician	35.2	1,169	8.68
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH8108	5.3	G	19	0	Bldg Laborer	1.5	36	8.67
REDUCE LIGHTING LEVELS	DC33001	267.9	C	931	0	Electrician	35.2	1,169	8.66
REDUCE LIGHTING LEVELS	DC39033	268.5	C	937	0	Electrician	35.9	1,190	8.57
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH51432	6.8	G	25	0	Bldg Laborer	2.0	48	8.55
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH51621	6.8	G	25	0	Bldg Laborer	2.0	48	8.55
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH5551	3.4	G	12	0	Bldg Laborer	1.0	24	8.18
INSULATE PIPES	C321	46.9	G	176	228	Plumber	3.7	379	7.75
INSULATE PIPES	C53	46.9	G	176	228	Plumber	3.7	379	7.75
INSULATE PIPES	C2224	46.9	G	176	228	Plumber	3.7	379	7.75
INSULATE PIPES	C2808	46.9	G	176	228	Plumber	3.7	379	7.75
REDUCE LIGHTING LEVELS	MP35014	266.9	C	946	0	Electrician	40.3	1,337	7.71
INSULATE PIPES	A237	18.8	G	70	92	Plumber	1.5	154	7.58
INSULATE PIPES	A133	18.8	G	70	92	Plumber	1.5	154	7.58
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH5552	3.0	G	11	0	Bldg Laborer	1.0	24	7.50
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH5559	3.0	G	11	0	Bldg Laborer	1.0	24	7.50
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH60005	3.0	G	11	0	Bldg Laborer	1.0	24	7.50
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH5210	3.0	G	11	0	Bldg Laborer	1.0	24	7.50
AUXILIARY EQUIPMENT OPERATION CONTROL(c)	DC330	18.5	C	65	19	Electrician	3.6	145	6.92
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH5202	2.8	G	10	0	Bldg Laborer	1.0	24	6.82
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH6618	1.5	G	5	0	Bldg Laborer	0.5	12	6.82
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH6759	1.5	G	5	0	Bldg Laborer	0.5	12	6.82
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH8210	1.5	G	5	0	Bldg Laborer	0.5	12	6.82
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH5216	2.8	G	10	0	Bldg Laborer	1.0	24	6.82
REDUCE LIGHTING LEVELS	A10032	39.9	C	133	0	Electrician	5.4	180	6.38
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH51407	7.2	G	27	0	Bldg Laborer	3.0	72	6.25
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH51405	9.5	G	35	0	Bldg Laborer	4.0	96	6.06
AMBIENT AIR BOILER LOCKOUT CONTROL	B21008	62.3	C	217	281	Electrician	5.4	582	5.69
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH5557	2.2	G	8	0	Bldg Laborer	1.0	24	5.45
AUXILIARY EQUIPMENT OPERATION CONTROL(a)	DC330	93.7	E	275	257	Electrician	8.3	581	5.39
LOWER DOMESTIC HOT WATER TEMPERATURE	P112	1.9	G	7	0	Bldg Laborer	1.0	24	4.77
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH5208	2.0	G	7	0	Bldg Laborer	1.0	24	4.77
REDUCE LIGHTING LEVELS	A12022	53.5	C	179	0	Electrician	9.2	304	4.31
REDUCE LIGHTING LEVELS	A10013	55.4	C	185	0	Electrician	9.5	316	4.26
AUXILIARY EQUIPMENT OPERATION CONTROL(d)	A1802	24.8	E	72	49	Electrician	4.9	225	3.64
AMBIENT AIR BOILER LOCKOUT CONTROL	B10001	61.8	C	218	527	Electrician	7.3	947	3.57
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH60001	1.4	G	5	0	Bldg Laborer	1.0	24	3.41
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH60000	1.4	G	5	0	Bldg Laborer	1.0	24	3.41
INSTALL ECONOMIZER CONTROLS	A91035	35.3	E	71	0	HVAC Tech	8.0	283	3.00
REDUCE INFILTRATION	MP9112	73.6	G	277	328	Carpenter	23.3	1,065	2.85
AMBIENT AIR BOILER LOCKOUT CONTROL	B14020	30.9	C	108	318	Electrician	4.5	598	2.80
REDUCE INFILTRATION	MP9553	63.9	G	240	301	Carpenter	21.4	978	2.69
REDUCE INFILTRATION	MP35023	63.9	G	240	304	Carpenter	21.6	987	2.67

TABLE 2.3.1 (Continued)
NO COST/LOW COST PROJECT SUMMARY
FT HOOD, TX
FEASIBLE PROJECTS ONLY

PROJECT	BUILDING NUMBER	SOURCE ENERGY SAVINGS (MBTU/YR)	TYPE (e)	FIRST YEAR DOLLAR SAVINGS ($/YR)	COST TO IMPLEMENT MATERIAL COST ($)	JOBHOURS TRADE	JOBHOURS HOURS	TOTAL COST ($)	SAVINGS TO INVESTMENT RATIO (SIR)
REDUCE INFILTRATION	MP38014	63.9	G	240	305	Carpenter	21.7	993	2.65
REDUCE LIGHTING LEVELS	A9426	9.8	C	33	0	Electrician	2.4	80	2.46
REDUCE INFILTRATION	MP35014	63.9	G	240	337	Carpenter	24.0	1,097	2.40
AUXILIARY EQUIPMENT OPERATION CONTROL(c)	DC36014	10.4	E	30	19	Electrician	3.6	145	2.34
REDUCE INFILTRATION	MP38053	54.9	G	206	304	Carpenter	21.6	987	2.29
AMBIENT AIR BOILER LOCKOUT CONTROL	MP38014	19.0	C	67	234	Electrician	3.7	457	2.28
REDUCE INFILTRATION	MP13029	54.9	G	206	339	Carpenter	24.2	1,103	2.05
REDUCE INFILTRATION	MP15011	54.9	G	206	339	Carpenter	24.2	1,103	2.05
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH51413	11.4	G	42	130	Plumber	6.0	372	1.89
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH51432	7.6	G	28	86	Plumber	4.0	248	1.88
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH51433	3.8	G	14	43	Plumber	2.0	124	1.87
REDUCE LIGHTING LEVELS	A10031	29.9	C	100	0	Electrician	8.1	272	1.84
INSTALL ELECTRONIC IGNITION	B29009	21.0	G	79	368	Electrician	9.0	813	1.62
INSTALL ELECTRONIC IGNITION	B29008	21.0	G	79	368	Electrician	9.0	813	1.62
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH5552	3.2	G	12	43	Plumber	2.0	124	1.61
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH60004	3.2	G	12	43	Plumber	2.0	124	1.61
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH60000	3.2	G	12	43	Plumber	2.0	124	1.61
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH5559	3.2	G	12	43	Plumber	2.0	124	1.61
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH6618	1.6	G	6	22	Plumber	1.0	62	1.61
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH60001	3.2	G	12	43	Plumber	2.0	124	1.61
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH5557	3.2	G	12	43	Plumber	2.0	124	1.61
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH60009	3.2	G	12	43	Plumber	2.0	124	1.61
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH60005	3.2	G	12	43	Plumber	2.0	124	1.61
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH60104	3.2	G	12	43	Plumber	2.0	124	1.61
AMBIENT AIR BOILER LOCKOUT CONTROL	A10031	2.2	C	7	0	Electrician	2.0	73	1.59
AMBIENT AIR BOILER LOCKOUT CONTROL	A10032	2.1	C	7	0	Electrician	2.0	73	1.59
AMBIENT AIR BOILER LOCKOUT CONTROL	DC36014	28.4	C	88	388	Electrician	5.9	746	1.53
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH51621	5.6	G	21	86	Plumber	4.0	248	1.41
INSULATE PIPES	A12022	2.3	G	8	49	Plumber	1.3	97	1.36
INSULATE PIPES	A10014	2.3	G	8	49	Plumber	1.3	97	1.36
INSULATE PIPES	A10012	2.3	G	8	49	Plumber	1.3	97	1.36
INSULATE PIPES	A10013	2.3	G	8	49	Plumber	1.3	97	1.36
LOWER DOMESTIC HOT WATER TEMPERATURE-FAMILY HOUSING	FH6773	0.4	G	1	0	Bldg Laborer	0.5	12	1.36
INSULATE PIPES	A10031	2.3	G	8	49	Plumber	1.3	97	1.36
INSULATE PIPES	A10032	2.3	G	8	49	Plumber	1.3	97	1.36
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH5208	2.8	G	10	43	Plumber	2.0	124	1.34
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH6759	1.4	G	5	22	Plumber	1.0	62	1.34
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH5202	2.8	G	10	43	Plumber	2.0	124	1.34
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH5216	2.8	G	10	43	Plumber	2.0	124	1.34
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH6773	1.4	G	5	22	Plumber	1.0	62	1.34
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH5551	2.8	G	10	43	Plumber	2.0	124	1.34
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH8210	1.4	G	5	22	Plumber	1.0	62	1.34
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH5210	2.8	G	10	43	Plumber	2.0	124	1.34
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH51405	9.6	G	36	172	Plumber	8.0	496	1.21
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH51407	7.2	G	27	130	Plumber	6.0	372	1.21

TABLE 2.3.1 (Continued)
NO COST/LOW COST PROJECT SUMMARY
FT HOOD, TX
FEASIBLE PROJECTS ONLY

PROJECT	BUILDING NUMBER	SOURCE ENERGY SAVINGS (MBTU/YR)	TYPE (e)	FIRST YEAR DOLLAR SAVINGS ($/YR)	COST TO IMPLEMENT MATERIAL COST ($)	JOBHOURS TRADE	JOBHOURS HOURS	TOTAL COST ($)	SAVINGS TO INVESTMENT RATIO (SIR)
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH51426	4.8	G	18	86	Plumber	4.0	248	1.21
INSULATE DOMESTIC HOT WATER TANKS - FAMILY HOUSING	FH8108	3.6	G	13	65	Plumber	3.0	186	1.16
AMBIENT AIR BOILER LOCKOUT CONTROL	A12022	1.5	C	5	0	Electrician	2.0	73	1.14
AMBIENT AIR BOILER LOCKOUT CONTROL	A10014	1.5	C	5	0	Electrician	2.0	73	1.14
AMBIENT AIR BOILER LOCKOUT CONTROL	A10012	1.5	C	5	0	Electrician	2.0	73	1.14
AMBIENT AIR BOILER LOCKOUT CONTROL	A10013	1.5	C	5	0	Electrician	2.0	73	1.14
INSULATE DOMESTIC HOT WATER TANKS	A34011	1.2	G	4	24	Plumber	1.0	62	1.07
INSULATE PIPES	A28000	11.3	G	42	385	Plumber	7.0	661	1.06
INSTALL STORM WINDOWS	F57019	9.8	C	30	324	Glazer	4.5	528	1.01
TOTALS		12,242.2	C	40,199				48,094	10.23

Footnotes

(a) VACUUM PUMP TIMER PROJECT
(b) AIR COMPRESSOR TIMER PROJECT
(c) DHW TIMER PROJECT
(d) EXHAUST FAN TIMER PROJECT
(e) G denotes Natural Gas Savings, E denotes Electricity Savings, and C denotes combined Natural Gas and Electricity Savings.

2.3.2 Quick Return on Investment Program (QRIP)

One QRIP project is recommended from this ESOS: automatically controlling the exterior lights of the motor pools. The exterior lighting is currently manually controlled. The lights are turned on when personnel leave in the evening and turned off when personnel arrive in the morning. This project entails the installation of an exterior photocell system, reducing the average daily hours of operation in thirty-one (31) motor pools. The cost to implement the project is $15,066 and will amortize in 1.00 years, meeting the QRIP requirements. The project will save 3,010.1 MBtu/Yr of energy resulting in annual cost savings of $13,623. The resulting SIR is 8.90. Analysis details are located in Appendix G2.8, in Volume II of this report.

2.3.3 OSD Productivity Investment Funding (PIF)

No ECO's recommended for implementation at Fort Hood are categorized as OSD PIF projects.

2.3.4 Productivity Enhancing Capital Investment Program (PECIP)

No ECO's recommended for implementation at Fort Hood are categorized as PECIP projects.

2.3.5 Other Projects

Three (3) projects were analyzed that do not fit into any of the categories described. The first project, Install Energy Savings Fluorescent Lighting, recommends replacing existing forty watt (40W) lamps in Building 28000 with thirty-four watt (34W) energy savers. Energy saving fluorescent lamps produce a lighting level equivalent to their standard counterparts, but require five (5) to six (6) fewer watts per lamp. The implementation cost is $32,469 project will save 1,141.2 MBtu/Yr of energy, corresponding to an annual dollar savings of $3,164. Analysis details are located in Appendix G2.13, in Volume II of this report.

The second project, Install Limited Range Thermostats (Family Housing), recommends the installation of electric thermostats with limited range heating/cooling selections limiting the heating to a maximum of 68°F and the cooling to 78°F. The implementation cost for all the family housing buildings at Fort Hood is $824,998 and will save 98,287.9 MBtu/Yr of energy. The corresponding cost savings are $313,302. The SIR is 5.04 and the simple payback is 2.37 years. Appendix G1.15, in Volume II of this report provides a detailed account of the ECO's analysis.

During the analysis of this ECO, formal notification was received restricting the use of temperature restrictive thermostats in family housing (reference notice WU INFORMASTER 4-017. 041A150-027 05/30/85), so despite favorable economics, this project is omitted from this study's results. However, it is highly recommended for implementation.

The last project in the Other Projects category is Solar Pool Heating. This

project recommends two (2) modifications to Building 23001 including: 1) modifying the gas-fired pool heater to accept solar energy input from fifty (50) roof mounted collectors and 2) installing a pool cover. The cost to implement these two (2) modifications is $60,213, which will save 3,214.2 MBtu/Yr of energy. The cost savings are $10,669/Yr with a corresponding SIR of 3.13 and a simple payback of 5.08 years. Appendix G2.11, in Volume II of this report provides a detailed account of the ECO's analysis.

2.4 Energy Conservation Investment Program (ECIP)

This section presents the ECO and group of ECO's that are classified as ECIP projects. To qualify as an ECIP project, the project's total capital investment must exceed $200,000 and the project must exhibit an SIR greater than one (1.0).

Two (2) ECIP projects are recommended for implementation at Fort Hood. The first project, HVAC Modification combines four (4) ECO's, each of which qualifies as a feasible ECO when evaluated independently. The other project, Radiant Heaters, is made up of a single ECO. The following sections present a discussion of each ECIP project. Included is a description of the project, a summary of its impact on energy consumption, and its Life Cycle Cost Analysis (LCCA) results.

2.4.1 HVAC Modification (ECIP)

The first ECIP, HVAC Modification, encompasses four (4) ECO's: 1) Rezone HVAC Systems; chapels 2) Install High Efficiency Fan Motors; flight simulators and administration building 3) HVAC Controls Modification and 4) Provide FM Control of Chillers; barracks and administration buildings. The total ECIP implementation cost is $217,752. The project will save 78,041.4 MBtu of energy annually resulting in an annual dollar savings of $245,393. The SIR is 14.64, and the simple payback is 0.80 years. The following presents a discussion of each of the four (4) ECOs:

2.4.1.1 Rezone HVAC System - Chapels

Rezoning of the HVAC systems in the chapels involves separating the heating/cooling distribution systems for the sanctuary and office areas. Presently, both areas of the building are served by a common hot/chilled water circulation system. Heat is supplied to or removed from the space via manually operated fan coils. Consequently, there is no means of coordinating conditioning time to the varying occupancy schedules associated with the two areas.

Zoning is to be provided by splitting the circulation loop into two (2) sections, each served by a separate pump and control system. The control systems include time clocks for deactivation, manual override timers, low temperature protection, and automatic fan coil control.

Seven (7) chapels are recommended for this project; Building Nos. 9406, 10041, 12012, 24008, 31001, 37012, and 91074. The $67,446 project cost will save 10,470.4 MBtu/Yr of energy. The corresponding annual cost savings are $33,405. The SIR is 6.59 and the simple payback is 1.82 years. Appendix G2.5, in Volume II of this report contains the detailed analysis and calculations of this ECO with results summarized in Table 2.4.1.

TABLE 2.4.1
HVAC MODIFICATION SUMMARY

ECO	COST ($)	ENERGY SAVINGS (MBTU/YR)	DOLLAR SAVINGS ($/YR)	SIR	SIMPLE PAYBACK (YR)
HVAC Controls Modification	114,504	60,367.8	190,939	21.86	0.54
Provide FM Control of Chillers	21,398	6,117.8	17,858	9.52	1.08
Rezone HVAC System - Chapels	67,446	10,470.4	33,405	6.59	1.82
Install High Efficiency Fan Motors	14,404	1,085.4	3,191	2.53	4.06
TOTAL PROJECT	217,752	78,041.4	245,393	14.64	0.80

2.4.1.2 Install High Efficiency Fan Motors

Air handler unit fan motor replacement is recommended in Building Nos. 7019, 7050 and 28000. New high efficiency models are available, which result in electrical energy savings. The implementation cost is $14,404. The implementation will save 1,085.4 MBtu/Yr of energy, corresponding to $3,191/Yr. The SIR is 2.53 and the simple payback is 4.06 years. Analysis details of this ECO are located in Appendix G2.14, in Volume II of this report and the results are summarized in Table 2.4.1.

2.4.1.3 HVAC Controls Modification

In providing the recommended HVAC controls modification, five (5) measures are presented for implementation. Each improvement results in energy savings due to minimizing the overconditioning of interior spaces and are described as follows:

1. Reset interior temperature setpoints to 68°F for heating and 78°F for cooling.

2. Install locking thermostat covers or limited range thermostats to ensure that the above recommended setpoints are maintained.

3. Replace faulty thermostats.

4. Reduce HVAC system operation during unoccupied hours with time clock or FM radio control.

5. Install/repair night setback thermostats for 50°F or 55°F setback where possible.

Various combinations of these projects are recommended for different buildings at Fort Hood. The implementation cost for the project is $114,504. Implementation will result in energy savings of 60,367.8 MBtu/Yr and cost savings of $190,939/Yr. The SIR is 21.86, and the simple payback is 0.54 years. The ECO analysis details are located in Appendix G1.5, in Volume II of this report. The analysis results are summarized in Table 2.4.1.

2.4.1.4 Provide FM Control of Chillers

FM controls can be used to deactivate the chiller systems of buildings during times when the ambient conditions do not impose a cooling load. The $21,398 implementation cost provides FM controls of the chillers in Building Nos. 39043 and 36006.

Building 39043 is a mechanical plant serving barracks, administration buildings and a mess facility. An FM receiver/controller, step sequencer, and relay system is required to control shutdown of the chillers, chilled water and condenser water pumps when ambient temperatures are below 67°F. The control is provided only when the administration buildings are unoccupied because of high internal cooling loads during occupied periods. Complete shutdown of the chiller system in Building No. 36006 is also recommended when temperatures drop below 67°F. This barracks does not have excessive internal heat gains,

therefore, it can be shutdown during occupied periods. Implementation of this project will save 6,117.8 MBtu/Yr of energy, and the corresponding $17,858/Yr. The SIR is 9.52 and the simple payback is 1.08 years. Analysis details are in Appendix G2.6, in Volume II of this report. Savings and cost analysis results are summarized in Table 2.4.1.

2.4.1.5 HVAC Modification (ECIP) Summary

The total HVAC Modification ECIP project implementation cost is $217,752. Implementation will result in 58,665.1 MBtu/Yr electrical savings and 19,376.3 MBtu/Yr natural gas savings. This results in 78,041.4 MBtu/Yr total energy savings corresponding to cost savings of $245,393. The SIR is 14.64, and the simple payback is 0.80 years. These figures are delineated by project in Table 2.4.1.

2.4.2 Radiant Heaters (ECIP)

The second ECIP project, titled Radiant Heaters, involves installing gas radiant heaters in twenty-three (23) motor pools. Motor pools that are presently serviced by natural gas fired unit heaters are candidates for replacement with natural gas fired radiant heaters. The replacement is appropriate for only the vehicle bay areas in twenty-three (23) buildings. The project costs $465,336 and will save 10,798.5 MBtu/Yr of energy. These energy savings correspond to yearly cost savings of $40,618. The SIR is 1.46 and the simple payback is 10.31. Analysis details are located in Appendix G2.9, in Volume II of this report.

2.5 ECO's Suggested for Further Study

This section discusses potentially feasible ECO's identified but which are beyond the scope of work for this study. It is highly recommended that the ECO's be analyzed for feasibility. The following is a list of each ECO and a brief explanation.

- Provide Economizer Control. Many of the buildings' existing cooling systems are designed to provide a fixed amount of outside air or none at all. This potential ECO recommends modifying the systems and providing the necessary control to allow the system to utilize outside air for cooling whenever conditions are right. This project is recommended for buildings which experience high internal heat gains, thus, requiring cooling when ambient temperatures are below 75°F.

- Replace Stove Heaters With Forced Air Furnaces. This potential ECO applies to the older buildings currently used as administration and training facilities (i.e., 511 and 4217). Presently, these structures are heated by manually activated stoves which, when turned on, heat up and provide heat by natural convection. The heat is not efficiently distributed throughout the space leading to overheating in some areas and underheating in others. Due to the system's manual control, the units are frequently left on during unoccupied periods. It is recommended that these stoves be replaced with automatically controlled forced air furnaces.
- Provide FM Control For Shutdown of Barracks Cooling Systems. This ECO is analyzed for Building Nos. 36006 and 39043 (refer to Appendix G2.6). However, it is recommended that the ECO be evaluated for other

barracks. It is recommended that the chilled water system, chillers, chilled water and condenser water pumps, and cooling towers, be deactivated during favorable ambient conditions (67°F and below).

- Install Roof and Wall Insulation in Motor Pools. Presently, the roof and walls are uninsulated. Because they are constructed of metal, a considerable amount of heat energy is being lost to the outside.

- Install an Insulated Drop Ceiling in Motor Pools. This would be done in lieu of insulating the roof. The drop ceiling would reduce energy consumption in two ways: 1) by reducing the amount of exfiltration/infiltration within the building, and 2) by providing additional resistance to heat flow through the roof.

  Through interviews with motor pool personnel, it is determined that the drop ceilings can be installed at a height just above the roll-up doors in the bays and at the eight foot level above the second floor office areas.

- Provide Separation Between Bays and Offices in Motor Pools. In many of the motor pools, the second floor offices are open to the bays with only a screen mesh partition for separation. By installing a solid, insulated wall between the offices and bays, temperature levels within the offices can be better maintained, thereby allowing the interior bay temperature to be reduced without adverse affects.

- Replace Motor Pool Convector Heaters in Offices With Fan Coil Units. Some motor pools are presently heated by a hydronic system utilizing baseboard convector units in the office areas. The units either have hot water passing through them constantly or are manually controlled by a shut off valve. Consequently, the units are heating the space during unoccupied times or when the interior does not require any additional heat to maintain the comfort level. It is recommended that these convectors be replaced with thermostatically operated fan coil units. This would then eliminate the output of heat energy during periods of non-heating requirements.

2.6 Non-Feasible ECO's

Non-feasible ECO's are presented here in two fashions: 1) the general ECO is non-feasible, or 2) certain buildings within an otherwise feasible ECO are not feasible. Section 2.6.1 discusses the non-feasible ECO's and Section 2.6.2 details the results of specific buildings deemed non-feasible within feasible ECO's. In the latter case, the results of non-feasible buildings are not included in the ECO's results.

2.6.1 Non-Feasible General ECO's

The economic analysis of some ECO's investigated within this study exhibited SIR's of less than one (1.0). These non-feasible ECO's are listed and described below including the reason for poor feasibility.

- Chilled Water Reset Controls (Volume II, Appendix G1.11): This project is analyzed for Building 39033. The details in the appendix explain why the cost cannot be justified in terms of the slight Coefficient of Performance (C.O.P.) increase. This project applies only to this building.

- Improve Furnace Operation - Family Housing (Volume II, Appendix G1.16): Although the cost of sealing O.S.A. ducts and insulating furnace closet doors is small ($41 and $13, respectively) the savings that result are too inconsequential for the ECO to be feasible in any of the family housing units. To summarize, insulating the furnace door costs $13 and provides 0.03 MBtu or $0.11 annual savings. The resultant SIR is 0.14.

  In addition, the $41 cost required to seal the OSA make-up duct is not justified by the 0.213 MBtu or $0.71 annual savings. The resultant SIR of 0.25 substantiates the project's infeasibility.

- Addition of a Vestibule Entry to Building 7019 (Volume II, Appendix G1.20): The energy savings for this ECO result in less than eight dollars in savings annually. Installation of a vestibule to a building will have a considerable cost, large enough to not warrant detailed cost estimates for such insignificant savings. To summarize, the cost of adding a vestibule will be very high relative to the 2.0 MBtu or $7.20 annual savings. The anticipated SIR of much less than one demonstrates the infeasible economics.

- Preheat DHW With Condenser Waste Heat - Family Housing (Volume II, Appendix G2.1): This project has higher added annual costs than savings. To summarize, preheating DHW with condenser waste heat on a per residence basis costs $2,280 and provides 5.77 MBtu or a $22 value of annual savings. The total energy savings including increased maintenance are -$28.00 per year. The resultant SIR of -0.06 substantiates the ECO's infeasibility. The negative SIR is a result of incurred annual maintenance costs in excess of annual energy cost savings.

- Pulse Combustion Furnaces/Heaters (Volume II, Appendix G.2.2): Replacing existing functional furnaces/heaters does not save enough energy to warrant implementation. Replacing old furnaces would be more economical. To summarize, installing a pulse furnace in Building 9216 costs $2,794 and provides 11.6 MBtu or $40 annual savings. The resultant SIR of 0.23 demonstrates the ECO's poor economic feasibility.

  Installing a pulse boiler in Building 9426 costs $3,567 and provides 7.7 MBtu or $29 annual savings. The resultant SIR of 0.14 substantiates the project's infeasibility.

  Installing a pulse furnace and ductwork in Building 9426 costs $6,958 and provides 8.1 MBtu or $30 annual savings. The resultant SIR is 0.07 which demonstrates the poor economics.

- Install Urethane Insulation on Exterior Walls - Barracks (Volume II, Appendix G2.3): The SIR for this ECO is 0.86, almost meeting the feasibility requirement. Since the project is almost economically feasible, a price breakthrough on the materials and/or labor necessary would probably make this ECO feasible.

To summarize, insulating the barrack's walls costs $144,292 and provides 1,959.0 MBtu or $6,273 annual savings. The resultant SIR is 0.86 as stated above.

- Install Urethane Roof Insulation and Roof Coating - Barracks (Volume II, Appendix G2.4): Even though this ECO will save over $400 annually in energy costs, the savings are insufficient to recommend implementation in view of the cost.

  To summarize, insulating and coating the barracks' roof costs $21,882 and provides 132.0 MBtu or $404 annual savings. The resultant SIR of 0.33 demonstrates the non-feasible classification of this ECO.

- Storage Tanks vs Point of Use Heaters - Building No. 28000 (Volume II, Appendix G2.7): The implementation cost of $12,798 is not warranted due to the $158 annual savings.

  To summarize, installing point of use heaters costs $12,798 and provides 44.2 MBtu or $158 annual savings. The resultant SIR of 0.19 substantiates the ECO's infeasibility.

- Variable Air Volume Retrofit - Dental Clinics (Volume II, Appendix G2.10): This retrofit involves the removal of the existing steam coil and some ductwork, and installation of the new system. A $53,990 implementation cost is required. Due to this large cost, the substantial $2,057 savings are not enough to make this ECO economically feasible.

  To summarize, retrofitting a Dental Clinic's existing HVAC system to provide with VAV control costs $53,990 and provides 720.9 MBtu or $2,057 annual savings. The resultant SIR of 0.64 demonstrates the project's poor economic feasibility.

- Install Oxygen Trim (Volume II, Appendix G2.12): The analyzed building, 7050, is not applicable because the boiler size is below that recommended as the minimum for oxygen trim installation.

2.6.2 Non-Feasible Buildings Within Feasible ECO's

The remaining ECO's have been thoroughly analyzed and are all economically feasible for certain buildings. Particular buildings within the projects are not economical or applicable to the ECO, so are not recommended. The following list details which buildings within the feasible ECO's are not feasible. If a previously classified "feasible" ECO is not listed here, it indicates that all buildings analyzed within the ECO are feasible.

- Insulate Domestic Hot Water Tanks (Volume II, Appendix G1.3): Building Nos. 29008 and 29009 were not analyzed because the tanks were already insulated.

- Insulate Pipes (Volume II, Appendix G1.4): Motor Pool No. 38014 is not feasible. Although the energy savings, 18.8 MBtu/Yr, exceed savings for some of the analyzed buildings, the implementation cost of $2,122 associated with this building is much greater. The $70/Yr savings results in an SIR of only 0.55, requiring 27.29 years for simple payback.

- Install Electronic Ignition (Volume II, Appendix G1.6): Most of the buildings analyzed for the installation of electronic ignition were economically infeasible. These buildings have maintenance schedules which specify that the pilot lights be turned off seasonally. The cost cannot be justified for savings that occur only part of the year. Barracks Nos. 12003, 14020, 21008, and 37008, Chapels Nos. 53, 321, 2224, and 2808, and Dental Clinic Nos. 9440 and 33001 have SIR's of 0.32. The implementation cost of $417, saving 2.3 MBtu and $8 annually, results in a 47.00 year simple payback. Administration Building No. 912 costs $271 to implement and also saves 2.3 MBtu of natural gas and $8 annually. The SIR is 0.49, with a simple payback of 30.50 years. Administration Buildings Nos. 2334, 4217, 9216, 9217, 9416, 35022 and 92076 cost $271 per building to install. The savings range from 4.6 to 9.2 MBtu/Yr and $17 to $34 resulting in an SIR of 0.52 and a simple payback of 28.71 years. Administration Building Nos. 508 and 511, and Motor Pool Nos. 9112, 9553, 13029, and 15011 have variable costs ranging from $2,439 to $4,065, and save from 20.7 to 34.5 MBtu and $78 to $130 annually. The SIR for each of the four motor pools and two administration buildings above is 0.53 and the simple payback is 28.15 years for each of the buildings. Motor Pools 35023 and 38053 cost $3,252 each to implement, and save 27.6 MBtu and $104 annually. Each has an SIR of 0.54 and a simple payback of 28.14 years.

- Install Economizer Controls (Volume II, Appendix G1.7): This No Cost/Low Cost ECO is not applicable to Building Nos. 39033, 34011, 92076 and 33001. Building Nos. 34011 and 92076 would require an outside contractor for system installation. Building Nos. 39033 and 33001 presently have working economizers. The ECO is infeasible due to cost restraints for Administration Building Nos. 9216 and 9217 and Chapel No. 91074, because they do not have economizers in place. Flight Simulator No. 7019 is also not feasible. Although it has economizer controls installed, it has humidification control which lowers the savings. The costs for these infeasible buildings range from $283 to $4,526. Savings range from 7.8 MBtu and -$10 to 17.6 MBtu and $8 annually. The resultant SIR's range from 0.00 to 0.02.

- Auxiliary Equipment Operation Control (Volume II, Appendix G1.8): Building No. 91035 was not analyzed because no auxiliary HVAC equipment exists that could be effectively time clock controlled.

- Ambient Air Boiler Lockout Control (Volume II, Appendix G1.9) In Building No. 7019, the boiler is constantly needed for humidification control, so is not analyzed. Building No. 28000 presently has a functional boiler lockout control. Building No. 23001 needs the boiler for continuous pool heating. If a solar heating system is installed, a boiler is still necessary to provide back-up heating. The central plant serving Building Nos. 29008 and 29009 is not included in the Scope of Work, and so these buildings were not analyzed. Of the analyzed buildings, two are non-feasible. Dental Clinic No. 33001 has an implementation cost of

$598 and saves 8.4 MBtu of electricity and 3.7 MBtu of natural gas per year equating to $37. The resultant SIR is 0.82 with a simple payback of 14.57 years. Chapel 4416, with an implementation cost of $404 and annual savings of $10 is also non-feasible. The energy savings are 3.0 MBtu/Yr with a resultant SIR of 0.38 and simple payback of 36.40 years.

- Reduce Infiltration (Volume II, Appendix G1.18): Due to the high cost of door/window sealing, some buildings are not feasible. These are Motor Pool Nos. 13029 and 35014 (sealing doors and windows, but not roll-up door threshold weatherstripping), Administration Building Nos. 237, 511, 9216, and 34011, and Chapel Nos. 4416 and 9406. The costs range from $1,616 to $17,089 saving from 7.1 to 191.7 MBtu/Yr with first year dollar savings of -$30 to $722. The SIR's range from zero to 0.94 with simple paybacks in excess of 10.46 years.

- Provide FM Control of Chillers (Volume II, Appendix G2.6): This ECO is infeasible for Building No. 28000. The $9,341 implementation cost saves only 19.0 MBtu/Yr of energy. The first year dollar savings are -$19, resulting in an SIR of 0.00 and a simple payback of never.

- Install High Efficiency Fan Motors (Volume II, Appendix G2.14): Although all buildings analyzed are feasible, one air handler unit in Building No. 7019 (AHU-3) is not. The $369 cost saves $24/Yr (only 8.4 MBtu) for an SIR of 0.74 and a simple payback of 13.87 years.

3.0 CONCLUSIONS AND RECOMMENDATIONS

Section 3 summarizes the results of the ESOS study conducted at Fort Hood, Texas. The impact on annual energy consumption associated with each ECO recommended for implementation is presented in Section 3.1. Recommendations are ranked in order of the Savings-to-Investment Ratio (SIR) for each ECO as a stand alone project. Section 3.2 concludes with a discussion of the proposed implementation plan for energy conservation projects at Fort Hood. These projects include ECO's as stand alone projects and the packaged programmed projects.

3.1 Summary of Recommended ECO's

Section 3.1 presents a summary of the ECO's discussed in Section 2.0 of this Executive Summary. Each opportunity is shown as a stand alone project for the purpose of comparison.

Table 3.1.1 lists each ECO in order of decreasing Savings-to-Investment Ratio (SIR). The ECO's implementation cost, annual energy savings, associated annual dollar savings, SIOH, SIR, simple payback, analysis period, analysis date, and project classification. Review of Table 3.1.1 shows that each ECO qualifies on its own merit as a feasible means of reducing Fort Hood's annual energy consumption.

3.2 Implementation Plan

Section 3.2 presents the plan for implementing the ECO's recommended in this study. The plan recommends the implementation of fourteen (14) No Cost/Low Cost projects, one (1) QRIP project, two (2) ECIP projects, and two (2) Other projects. Each ECO included in the nineteen (19) projects is discussed in Section 2.

Table 3.2.1 presents the nineteen (19) projects recommended for implementation. Each recommendation is a single ECO other than the ECIP project HVAC Modification which combines the results of four (4) separate ECO's. Included in Table 3.2.1 are the projects' implementation costs, annual energy savings, annual dollar savings, SIOH, SIR, simple payback, analysis period, analysis date, project classification, and program year and cost where applicable. It can be seen that upon implementation of the nineteen (19) projects, annual electricity consumption at Fort Hood will be reduced 72,803.0 MBtu/Yr and natural gas 35,644.6 MBtu/Yr. For a combined investment of $838,920, total annual energy consumption will be reduced by 108,447.6 MBtu/Yr, which equates to an annual dollar savings of $353,666. The economics are very attractive at an SIR of 5.62 and a simple payback of 2.13 years.

Figure 3.2.1 shows the impact of these energy savings in relation to the estimated annual consumption of contracted buildings. The annual totals for both electricity and natural gas consumption are derived for the contracted buildings from the past year's consumption (July 1984 through June 1985) for the entire Fort Hood installation. The ratio of the contracted buildings total square footage to the installations total building square footage is applied to the total annual consumption for both energy sources. Considering the total annual consumption of 3,340,867.6 MBtu/Yr of electricity and 1,618,287.9 MBtu/Yr of natural gas associated with the installation's 23,347,236 square feet of

TABLE 3.1.1

RECOMMENDED ECO'S SUMMARY

PROJECT TITLE	PROJECT COST ($)	ANNUAL ENERGY SAVINGS (MBTU/YR) NG	ELEC	TOTAL	ANNUAL DOLLAR SAVINGS ($)	SIOH ($)	SIR	SIMPLE PAYBACK (YRS)	ANALYSIS PERIOD (YRS)	ANALYSIS DATE	PROJECT CLASSIFICATION
HOT WATER RESET CONTROLS	34	46.8	0.0	46.8	176	2	85.48	0.18	15	1985	NC/LC
LOWER DHW TEMPERATURE	396	454.6	37.4	492.0	1,822	36	75.39	0.20	15	1985	NC/LC
INSTALL FLOW RESTRICTORS	769	893.7	0.0	893.7	3,369	41	73.21	0.21	15	1985	NC/LC
INSTALL ECONOMIZER CONTROLS	849	0.0	639.2	639.2	1,783	45	24.06	0.43	15	1985	NC/LC
HVAC CONTROLS MODIFICATION	114,504	16,215.3	44,152.5	60,367.8	190,939	5,496	21.86	0.54	15	1985	ECIP(a)
AUXILIARY EQUIPMENT OPERATION CONT.	7,503	63.8	4,705.7	4,769.5	14,074	400	21.55	0.49	15	1985	NC/LC
PROVIDE FM CONTROLS FOR CHILLERS	21,398	0.0	6,117.8	6,117.8	17,858	1,061	9.52	1.08	15	1985	ECIP(a)
REDUCE LIGHTING LEVELS	15,917	(291.5)	4,347.1	4,055.6	14,006	791	9.48	1.02	15	1985	NC/LC
CONTROL EXTERIOR MOTOR POOL LIGHTS	15,066	0.0	3,010.1	3,010.1	13,623	694	8.90	1.00	15	1985	QRIP
LOWER DHW TEMPERATURE - FAM. HOUS.	828	108.7	0.0	108.7	409	69	8.26	1.82	15	1985	NC/LC
REZONE HVAC SYSTEM - CHAPELS	67,446	3,161.0	7,309.4	10,470.4	33,405	3,114	6.59	1.82	15	1985	ECIP(a)
INSULATE PIPES	3,067	250.3	0.0	250.3	943	161	5.14	2.93	15	1985	NC/LC
AMBIENT AIR BOILER LOCKOUT CONTROL	3,914	224.7	112.6	337.3	1,178	189	4.58	2.99	15	1985	NC/LC
SOLAR POOL HEATING - BUILDING 23001	60,213	3,214.2	0.0	3,214.2	10,669	2,879	3.13	5.08	15	1985	OTHER
INSTALL HIGH EFFICIENCY FAN MOTORS	14,404	0.0	1,085.4	1,085.4	3,191	720	2.53	4.06	15	1985	ECIP(a)
REDUCE INFILTRATION	8,313	493.9	0.0	493.9	1,862	437	2.46	4.02	10	1985	NC/LC
INSTALL ELECTRONIC IGNITION	1,626	42.0	0.0	42.0	158	78	1.62	9.27	15	1985	NC/LC
INSULATE DHW TANKS - FAM. HOUS.	4,278	102.2	0.0	102.2	385	276	1.51	10.00	15	1985	NC/LC
RADIANT HEATERS	465,336	10,688.1	110.4	10,798.5	40,618	22,333	1.46	10.31	15	1985	ECIP
INSTALL ENERGY SAVING FLRSCNT LAMPS	32,469	(26.0)	1,167.2	1,141.2	3,164	1,693	1.10	9.23	15	1985	OTHER
INSULATE DHW TANKS	62	1.2	0.0	1.2	4	4	1.07	14.00	15	1985	NC/LC
INSTALL STORM WINDOWS	528	1.6	8.2	9.8	30	26	1.01	15.87	25	1985	NC/LC
TOTALS	838,920	35,644.6	72,803.0	108,447.6	353,666	40,545	5.62	2.13	NA	1985	NA

(a) These four ECO's comprise the ECIP project HVAC MODIFICATION.

TABLE 3.2.1

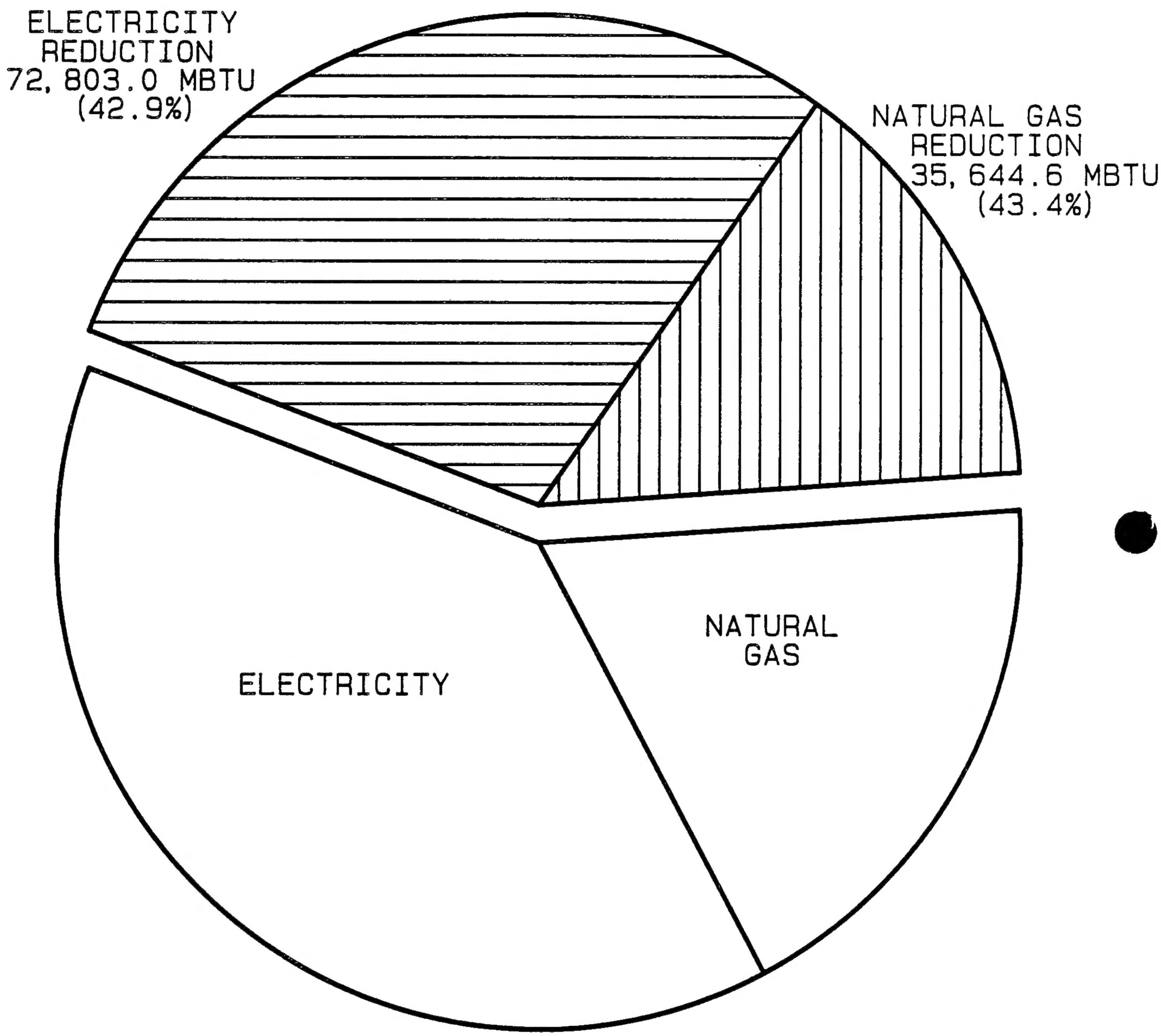
RECOMMENDED PROJECTS SUMMARY

PROJECT TITLE	PROJECT COST ($)	ANNUAL ENERGY SAVINGS (MBTU/YR) NG	ELEC	TOTAL	ANNUAL DOLLAR SAVINGS ($)	SIOH ($)	SIR	SIMPLE PAYBACK (YRS)	ANALYSIS PERIOD (YRS)	ANALYSIS DATE	PROJECT CLASSIFICATION	PROGRAM YEAR	PROGRAM YEAR COST ($)
HOT WATER RESET CONTROLS	34	46.8	0.0	46.8	176	2	85.48	0.18	15	1985	NC/LC	(a)	(a)
LOWER DHW TEMPERATURE	396	454.6	37.4	492.0	1,822	36	75.39	0.20	15	1985	NC/LC	(a)	(a)
INSTALL FLOW RESTRICTORS	769	893.7	0.0	893.7	3,369	41	73.21	0.21	15	1985	NC/LC	(a)	(a)
INSTALL ECONOMIZER CONTROLS	849	0.0	639.2	639.2	1,783	45	24.06	0.43	15	1985	NC/LC	(a)	(a)
AUXILIARY EQUIPMENT OPERATION CONT.	7,503	63.8	4,705.7	4,769.5	14,074	400	21.55	0.48	15	1985	NC/LC	(a)	(a)
HVAC MODIFICATION	217,752	19,376.3	58,665.1	78,041.4	245,393	10,391	14.64	0.80	15	1985	ECIP	1988	249,033
REDUCE LIGHTING LEVELS	15,917	(291.5)	4,347.1	4,055.6	14,006	791	9.48	1.02	15	1985	NC/LC	(a)	(a)
CONTROL EXTERIOR MOTOR POOL LIGHTS	15,066	0.0	3,010.1	3,010.1	13,623	694	8.90	1.00	15	1985	QRIP	1986	15,397
LOWER DHW TEMPERATURE - FAM. HOUS.	828	108.7	0.0	108.7	409	69	8.26	1.82	15	1985	NC/LC	(a)	(a)
INSULATE PIPES	3,067	250.3	0.0	250.3	943	161	5.14	2.93	15	1985	NC/LC	(a)	(a)
AMBIENT AIR BOILER LOCKOUT CONTROL	3,914	224.7	112.6	337.3	1,178	189	4.58	2.99	15	1985	NC/LC	(a)	(a)
SOLAR POOL HEATING - BUILDING 23001	60,213	3,214.2	0.0	3,214.2	10,669	2,879	3.13	5.08	15	1985	OTHER	(b)	(b)
REDUCE INFILTRATION	8,313	493.9	0.0	493.9	1,862	437	2.46	4.02	10	1985	NC/LC	(a)	(a)
INSTALL ELECTRONIC IGNITION	1,626	42.0	0.0	42.0	158	78	1.62	9.27	15	1985	NC/LC	(a)	(a)
INSULATE DHW TANKS - FAM. HOUS.	4,278	102.2	0.0	102.2	385	276	1.51	10.00	15	1985	NC/LC	(a)	(a)
RADIANT HEATERS	465,336	10,688.1	110.4	10,798.5	40,618	22,333	1.46	10.31	15	1985	ECIP	1988	492,700
INSTALL ENERGY SAVING FLRSCNT LAMPS	32,469	(26.0)	1,167.2	1,141.2	3,164	1,693	1.10	9.23	15	1985	OTHER	(b)	(b)
INSULATE DHW TANKS	62	1.2	0.0	1.2	4	4	1.07	14.00	15	1985	NC/LC	(a)	(a)
INSTALL STORM WINDOWS	528	1.6	8.2	9.8	30	26	1.01	15.87	25	1985	NC/LC	(a)	(a)
TOTALS	838,920	35,644.6	72,803.0	108,447.6	353,666	40,545	5.62	2.13	NA	1985	NA	NA	NA

(a) Program Year and Program Year Cost are not applicable because these projects are recommended for immediate implementation
(b) These projects are more capital intensive than the No Cost/Low Cost Projects but do not qualify economically as Programme Projects.

FIGURE 3.2.1
EFFECTS ON ANNUAL ENERGY CONSUMPTION
IN CONTRACTED BUILDINGS

TOTAL REDUCTION: 108,447.6 MBTU (43.0%)



EXISTING ANNUAL CONSUMPTION
ELECTRICITY: 169,720.7 MBTU/YR
NATURAL GAS: 82,191.8 MBTU/YR

TOTAL: 251,912.5 MBTU/YR

building area, the 1,186,029 square feet of contracted building area (5.08% of total area) consumes 169,720.7 MBtu of electricity and 82,191.8 MBtu of natural gas. Table 3.2.2 summarizes these results.

Referring, again, to Figure 3.2.1, it can be seen that upon implementation of the projects recommended in this study, electricity consumption will be reduced 42.9% and natural gas 43.4%, resulting in a total energy consumption reduction of 43.0%.

TABLE 3.2.2

TOTAL ENERGY CONSUMPTION IN CONTRACTED BUILDINGS

	FORT HOOD TOTAL	CONTRACTED BUILDINGS TOTAL
Building Area (Square Feet)	23,347,236[a,b]	1,186,029
Electricity Consumption (MBtu/Yr)	3,340,867.6[a,c]	169,720.7
Natural Gas Consumption (MBtu/Yr)	1,618,287.9[a,c]	82,191.8
Total Energy Consumption (MBtu/Yr)	4,959,155.5	251,912.5

(a) Information provided by Fort Hood Environmental Department.
(b) Current as of July 1985.
(c) Twelve (12) month consumption period from July 1984 through June 1985.